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THE LOWERING OF HIGH LAX VOWELS IN CENTRAL MINNESOTA ENGLISH: DOES IT HAPPEN IN OTHER DIALECTS?

ETTIEN KOFFI

Abstract

This paper is the third installment in an ongoing acoustic phonetic research devoted to Central Minnesota English (CMNE). The first paper, Koffi (2013), was a general description of the acoustic vowel space of CMNE vowels. The second paper, Koffi (2014), examined CMNE vowels in relation to Northern Cities Shift (NCS). The present paper investigates the lowering of the vowels [ɪ] and [ʊ] in CMNE. These two vowels are traditionally classified as [+high, +lax]. However, in Central Minnesota, acoustic measurements have shown that these two vowels have lowered so much that it would be erroneous to classify them as such. Since [ɪ] and [ʊ] lowering has not been sufficiently discussed in the sociophonetics literature, we are wondering if it is an idiosyncratic feature of CMNE or if it is taking place in other dialects. To answer this question, the acoustic vowel space of CMNE is compared with five other dialects of English spoken in North America: General American English (GAE), Mid West English (MWE), the dialect of English spoken in some northern cities (NCS), Southern California English (SCE), and Standard Canadian English (SCAE). The main insight gained from this research is that [ɪ] and [ʊ] are lowering in all dialects, but that the process is far more advanced in CMNE than in all the dialects discussed in this paper.

1.0 Introduction

The dialect of American English spoken in Central Minnesota is susceptible to influences from southern Minnesota, northern Minnesota, neighboring states and Canada. It may also be idiosyncratic to this region because of the immigrant populations who settled this part of Minnesota. The population of Central Minnesota is demographically fairly homogeneous. Over 94% of the current inhabitants are from European descent, many of whom are of German and/or Scandinavian ancestry (Koffi 2013:3). Regardless of whether CMNE is influenced by geographical or demographic factors, the vowels [ɪ] and [ʊ] produced by the speakers in this area behave in such a way that they deserve to be studied separately.

2.0 Data Analysis

A total of 34 Central Minnesota speakers, 12 males and 22 females, participated in this study. During the times of the data collection, from 2005 to 2012, the participants were all enrolled in my undergraduate Laboratory Phonology or my graduate sociolinguistics courses at St. Cloud State University. The vowel data obtained from these courses are very large. They include acoustic measurements of L1 and L2 Englishes. However, for this study, the data that are used are those provided by students who identified themselves as having lived in Central Minnesota for the first 17 years of their lives. Labov et al. (2013:30, 39) consider age 17 to be the age when a talker's dialect is fully stabilized and unlikely to undergo big acoustic changes. The participants recorded themselves or were recorded saying the words <heed, hid, hayed,

head, had, hod, hawed, hoed, hood, who'd, hud> three times.¹ It is the same list that Peterson and Barney (1952) used in their seminal paper on the acoustics of American vowels. Some 40 years later, Hillenbrand et al. (1995) replicated their methodology to study Midwest vowels. The findings reported in this study are based on 1,122 vowel samples (34 x 11 x 3). The phonetic data were analyzed using PRAAT, Version 5.3.16, while the plotting was done through Norm, Version 1.1. Since the female participants are more numerous than their male counterparts, the vowel charts are based on female speech. However, in every table, male measurements are also provided.

2.1 Robustness of the F1 Correlate

The focus of this paper is on vowel height. Consequently, the acoustic correlate that will receive the lion's share of attention is F1. Since this paper is intended for a general audience, it is important to explain briefly the role that F1 plays in the acoustic study of vowel production. First and foremost, F1 is interpreted according to the principle of inverse proportionality, that is, the smaller the F1 measurement, the higher the vowels. To put it slightly different, higher vowels have smaller F1 measurements, while lower vowels have bigger F1 measurements. Secondly, F1 is the most important of all the formants that make up vowels because it alone contains 80% of the acoustic energy found in vowels (Ladefoged and Johnson 2015:207). Lastly, if talkers from two different dialects produce the same vowel, and if the acoustic distance between their pronunciations of the same vowel is less than 20 Hz, it means that they produce it identically. This is so because human beings cannot perceive frequencies lower than 20 Hz. If the acoustic distance varies from 21 to 60 Hz, it means that the talkers produce the same vowel slightly differently. If the acoustic distance is ≥ 61 Hz, it means that they produce it substantially different. F2 corresponds to the horizontal movement of the tongue. Front vowels have higher F2 than back vowels. F2 plays some role in vowel intelligibility, but its overall impact on accent perception is not very significant. If speakers of different dialects produce the same vowel and the acoustic distance between them is ≤ 200 Hz, it means that they produce it identically (Koffi 2015). Most linguists do not include F3 information in acoustic vowel spaces because the role it plays, if any, is most of the time absorbed by F2. Now that the framework for interpreting the acoustic data to be used in this paper has been provided, let's see how [ɪ] and [ʊ] behave in CMNE. Thereafter, we will compare their behavior with that of their counterparts in five other dialects of English spoken in North America.

3.0 Central Minnesota English vs. General American English

We start our investigation with the landmark study done by Peterson and Barney (1952) on General American English (GAE) vowels. It is a useful reference point not only because it is taken to represent the "standard" American vowel system (Ladefoged and Disner 2012:27), but they also note on page 43 that it represents an "old-fashioned dialect." Seventy-six people participated in Peterson and Barney's original study: 36 men, 28 women, and 15 children. Their methodology has been replicated to study vowels in many dialects and languages all over the world. My study of CMNE vowels follows their methodology.

¹ The word <heard> is excluded from this study because [ə] is not a phoneme in English, but rather an allophone of various unstressed vowel phonemes that occur before [ɹ].

Words		fleece	kit	face	dress	trap	lot	thought	goat	foot	goose	strut
Male		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
GAE	F1	270	390	NA	530	660	730	570	NA	440	300	640
GAE	F2	2290	1990	NA	1840	1720	1090	840	NA	1020	870	1190
CMNE	F1	289	542	434	577	709	753	699	600	516	485	616
CMNE	F2	2298	1963	2185	1781	1737	1289	1296	1464	1467	1541	1365
Female		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
GAE	F1	310	430	NA	610	860	850	590	NA	470	370	500
GAE	F2	2790	2480	NA	2330	2050	1220	920	NA	1160	950	1640
CMNE	F1	385	573	508	754	848	855	851	569	626	417	743
CMNE	F2	2609	2232	2487	2028	1951	1462	1420	1117	1519	1230	1643

Table 1: Central Minnesota vs. General American Vowels

When the F1 and F2 formants of the vowels in Table 1 are plotted in the same acoustic vowel space, we obtain the following vowel quadrant:

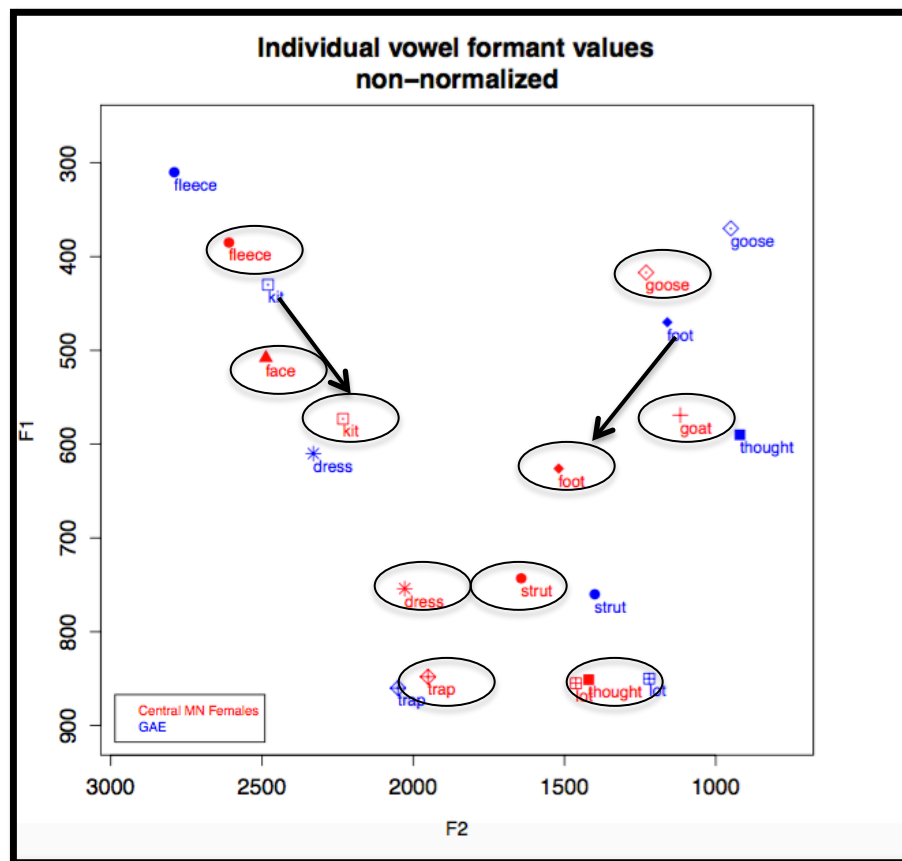


Figure 1: CMNE vs. GAE Vowels

The vowel [ɪ] (573 Hz) in CMNE is lower than its counterpart in GAE (430 Hz) by 143 Hz. Similarly, [ʉ] (626 Hz) in CMNE is lower than the one in GAE (470 Hz) by 156 Hz. Figure 1 shows that [ɪ] and [ʉ] in CMNE are also lower than [e] and [o], which are traditionally classified as mid vowels (Fromkin et al. (2014:207). In other words, the vowels [ɪ] and [ʉ]

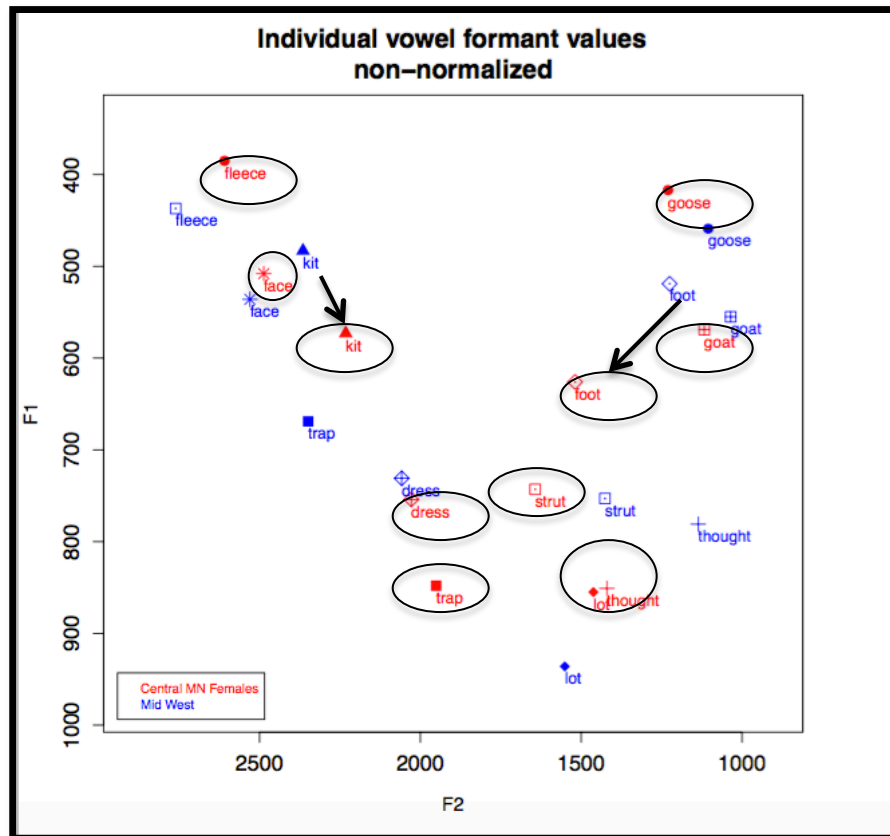
produced in CMNE have lowered so much that they should no longer be viewed as high vowels. They should instead be classified as mid vowels. The drastic lowering of [ʊ] can lead to a masking between [ʊ] and [ʌ]. Small (2005:79) reports that in some parts of the Midwest, college students in his phonetics courses often confuse both vowels. Ladefoged and Disner (2012:31) write that “Some Northern English speakers do not distinguish between *look* and *luck*.” The dialect of English spoken in the state of Minnesota as a whole qualifies as “Northern English” because Minnesota is the northernmost state of the US bordering Canada. I have conducted informal experiments in which I have asked some CMNE talkers to say, “*I exchanged my buck for a book*” or “*Ladefoged gave a book and a buck to his friend*.” I have recorded them in Siri, in Google, and with Dragon Dictate. In a number of instances, these voice recognition systems fail to distinguish between [ʊ] and [ʌ] when the speaker talks naturally. The sentences become: “*I exchanged my buck for a buck*” or “*I exchanged my book for a book*” or “*Ladefoged gave a book and a book to his friend*,” or “*Ladefoged gave a buck and a buck to his friend*.”

4.0 Central Minnesota English vs. Midwest English

Hillenbrand et al. (1995) replicated Peterson and Barney’s study some 40 years later. They recruited 139 participants: 45 men, 48 women, and 46 children. Eighty-seven percent of the participants were from Michigan. Minnesotans were mentioned among the participants, but their number is not known. Other participants came from Illinois, Wisconsin, northern Ohio, and northern Indiana (p. 3099). The non-descript label of “Midwest English” (MWE) is often given to this assortment of dialects. Table 2 and Figure 2 help compare and contrast the MWE with CMNE:

Words		fleece	kit	face	dress	trap	lot	thought	goat	foot	goose	strut
Male		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	289	542	434	577	709	753	699	600	516	485	616
CMNE	F2	2298	1963	2185	1781	1737	1289	1296	1464	1467	1541	1365
MWE	F1	381	450	487	709	564	956	868	548	578	450	760
MWE	F2	2313	1741	2215	1585	2097	1579	1368	1027	1283	1005	1216
Female		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	385	573	508	754	848	855	851	569	626	417	743
CMNE	F2	2609	2232	2487	2028	1951	1462	1420	1117	1519	1230	1643
MWE	F1	437	483	536	731	669	936	781	555	519	459	753
MWE	F2	2761	2365	2530	2058	2349	1551	1136	1035	1225	1105	1426

Table 2: Central Minnesota vs. Midwest Vowels



The F1 of [ɪ] (573 Hz) in CMNE has lowered by 90 Hz compared to the one in MWE (483 Hz). We see the same trend with [ʊ]. The one in CMNE (626 Hz) is lower by 107 Hz in relation to its counterpart in MWE (519 Hz). CMNE talkers are included among MWE speakers, but their [ɪ]s and [ʊ]s behave acoustically different.

Words		fleece	kit	face	dress	trap	lot	thought	goat	foot	goose	strut
Male		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	289	542	434	577	709	753	699	600	516	485	616
CMNE	F2	2298	1963	2185	1781	1737	1289	1296	1464	1467	1541	1365
NCS	F1	381	450	487	709	564	956	868	548	578	450	760
NCS	F2	2313	1741	2215	1585	2097	1579	1368	1027	1283	1005	1216
Female		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	385	573	508	754	848	855	851	569	626	417	743
CMNE	F2	2609	2232	2487	2028	1951	1462	1420	1117	1519	1230	1643
NCS	F1	381	450	487	709	564	956	868	548	578	450	760
NCS	F2	2313	1741	2215	1585	2097	1579	1368	1027	1283	1005	1216

Table 3: Central Minnesota vs. Northern Cities Shift

The F1 of [ɪ] (573 Hz) in CMNE is 123 Hz lower than the one in NCS (450 Hz). Furthermore, speakers in NCS regions centralize their [ɪ]s (1741 Hz) more than CMNE speakers (2232 Hz). The F2 distance between the two [ɪ]s is 491 Hz. Figure 3 displays how [ʊ] and [ɪ] in CMNE compares with their counterparts in NCS:

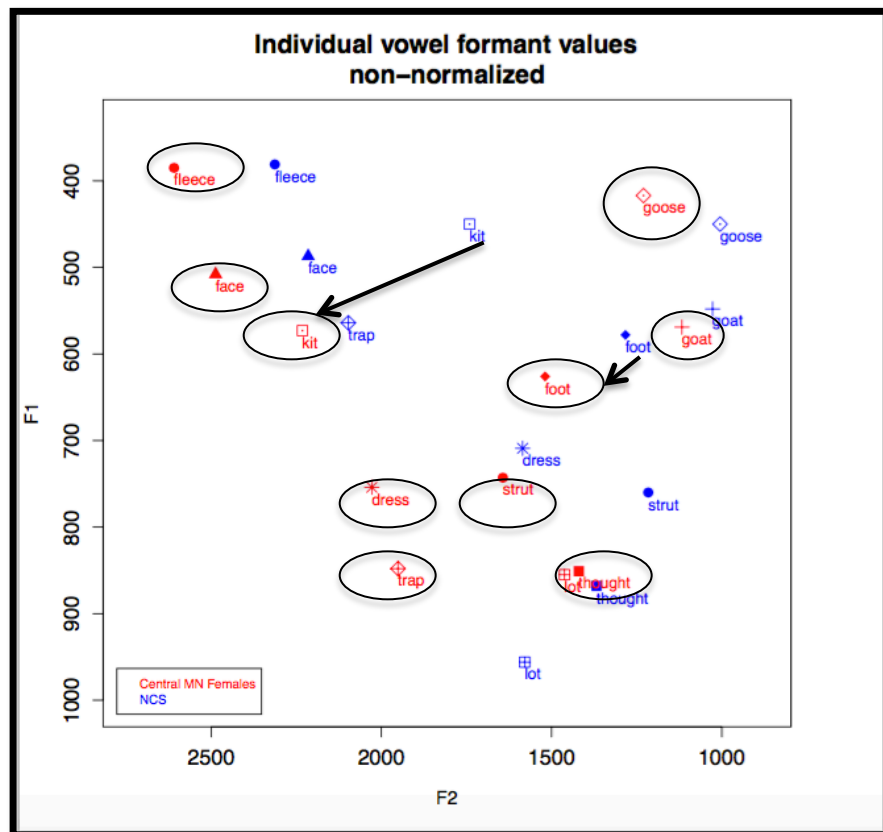


Figure 3: Central Minnesota vs. NCS Vowels

The F1 distance between the [ʊ] (626 Hz) in CMNE and the one in NCS (578 Hz) is 48 Hz. The lowering of [ʊ] is not as pronounced in NCS as it is in MWE (90 Hz) or GAE (143 Hz). This may be due to the fact that, according to Boberg (2008:138) NCS does not affect [ʊ]. In other words, the F1 characteristics of [ʊ] are not directly related to NCS. More will be said about this in 7.0.

6.0 Central Minnesota English vs. Southern California English

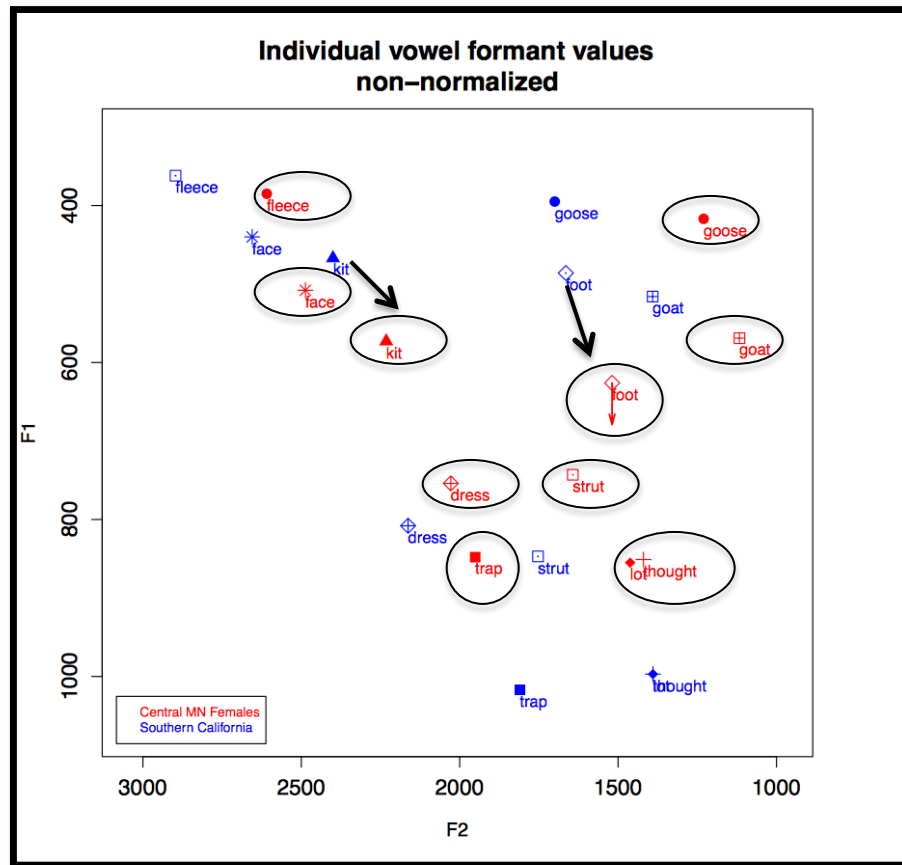
The data on Southern California English (SCE) comes mainly from Hagiwara (1997). He replicated Peterson and Barney's methodology in his study of SCE vowels. He collected data from 15 college students: nine women and six men. Table 4 displays the relevant measurements:

Words		fleece	kit	face	dress	trap	lot	thought	goat	foot	goose	strut
Male		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	289	542	434	577	709	753	699	600	516	485	616
CMNE	F2	2298	1963	2185	1781	1737	1289	1296	1464	1467	1541	1365
SCE	F1	291	418	403	529	685	710	710	437	441	323	574
SCE	F2	2338	1807	2059	1670	1601	1221	1221	1188	1366	1417	1415
Female		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	385	573	508	754	848	855	851	569	626	417	743
CMNE	F2	2609	2232	2487	2028	1951	1462	1420	1117	1519	1230	1643
SCE	F1	362	467	440	808	1017	997	886 ²	516	486	395	847
SCE	F2	2897	2400	2655	2163	1810	1390	1302	1391	1665	1700	1753

Table 4: Central Minnesota vs. Southern California Vowels

The F1 distance between [ɪ] (573 Hz) in CMNE and [ɪ] (467 Hz) in SCE is 106 Hz. The vowel [ʊ] is also 140 Hz lower in CMNE (626 Hz) than in SCE (486 Hz). Figure 5 reflects the difference between the two vowels.

² Hagiwara (1997) did not investigate [ɔ] because he concluded that it had merged with [ɑ]. The measurements provided here is the sum of Hagiwara's measurements for [ɑ] and Aiello's measurements for [ɔ].



It should be noted in passing that [ɑ] and [ɔ] behave similarly in SCE and CMNE. In both dialects, they have merged (see Eckert 2008:34 for the merger in SCE and Koffi 2013:12-14 for the one in CMNE). Another area of similarity between both dialects is that [e] has risen higher than [ɪ].

Boberg's (2008:137) study of the acoustic characteristics of Standard Canadian English (SCAE) allows us to compare [ɪ] and [ʊ] in CMNE with a dialect of English spoken outside of

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the continental USA. Boberg collected data from 86 participants: 51 females and 35 males. The acoustic characteristics of their speech are summarized in Table 5:

Words		fleece	kit	face	dress	trap	lot	thought	goat	foot	goose	strut
Male		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	289	542	434	577	709	753	699	600	516	485	616
CMNE	F2	2298	1963	2185	1781	1737	1289	1296	1464	1467	1541	1365
SCAE	F1	401	563	573	732	884	774	768	612	582	422	760
SCAE	F2	2494	2043	2189	1883	1724	1224	1211	1294	1332	1734	1501
Female		[i]	[ɪ]	[e]	[ɛ]	[æ]	[ɑ]	[ɔ]	[o]	[ʊ]	[u]	[ʌ]
CMNE	F1	385	573	508	754	848	855	851	569	626	417	743
CMNE	F2	2609	2232	2487	2028	1951	1462	1420	1117	1519	1230	1643
SCAE	F1	401	563	573	732	884	774	768	612	582	422	760
SCAE	F2	2494	2043	2189	1883	1724	1224	1211	1294	1332	1734	1501

Table 5: Central Minnesota vs. Canadian English Vowels

The comparison between the F1 of [ɪ] in SCAE (563 Hz) and its counterpart in CMNE (573 Hz), reveals that only 10 Hz separates them. In other words, [ɪ] has lowered as much in CMNE as it has in SCAE. The F1 acoustic distance between [ʊ] in SCAE (582 Hz) and [ʊ] in CMNE (626 Hz) is 44 Hz. The one in CMNE is slightly lower than the one produced by Canadians as a whole. However, when [ʊ] in CMNE is compared with the one produced in British Columbia (626 vs. 619 Hz), the two are indistinguishable. Only 7 Hz separates them. The same is true for speakers from the Toronto area, where only 19 Hz separates their [ʊ] (607 Hz) from its counterpart in CMNE (626 Hz). Table 6 lists the measurements of [ʊ] in various Canadian provinces:

Provinces of Canada	F1
British Columbia	619
Prairies (Alberta, Saskatchewan, Manitoba, northwest Ontario)	564
Southern Ontario	586
Toronto	607
Eastern Ontario	576
Quebec	567
Newfoundland	541
National Mean	582

Table 6: The Height of [ʊ] in Canadian Dialects

In order to appreciate fully the striking similarities between [ʊ] in CMNE and various Canadian dialects, we must refer to the following statement made by Boberg (2008:138):

While the phonetic position of /ʊ/ has not generally been regarded as related to the Canadian Shift, the F1 of /ʊ/ was found to be higher in British Columbia than in the Prairies or anywhere east of Toronto; it was significantly higher in Toronto than in the Prairies or in Newfoundland. This suggests a lowering of /ʊ/ in words like *cook*, *foot*, *stood*, that is particularly centered in Toronto. This development may indeed be completely independent of the Canadian Shift, since lowering of /ʊ/ is not related to the lowering or retraction of the front short vowel in any obvious way. Of the nine

participants with the highest F1 values for /ʊ/ (greater than 640 Hz), three are from Toronto, three from Vancouver, two from Nova Scotia, and one from Ottawa, indicating a strong Ontario/British Columbia urban bias for this feature. By contrast, participants with low F1 values for /ʊ/ tend to come from Atlantic Canada, Quebec, and the Prairies.

The similarities between [ʊ] in CMNE and SCEA are displayed in Figure 6. The arrows underscore the reduced acoustic distance between vowels:

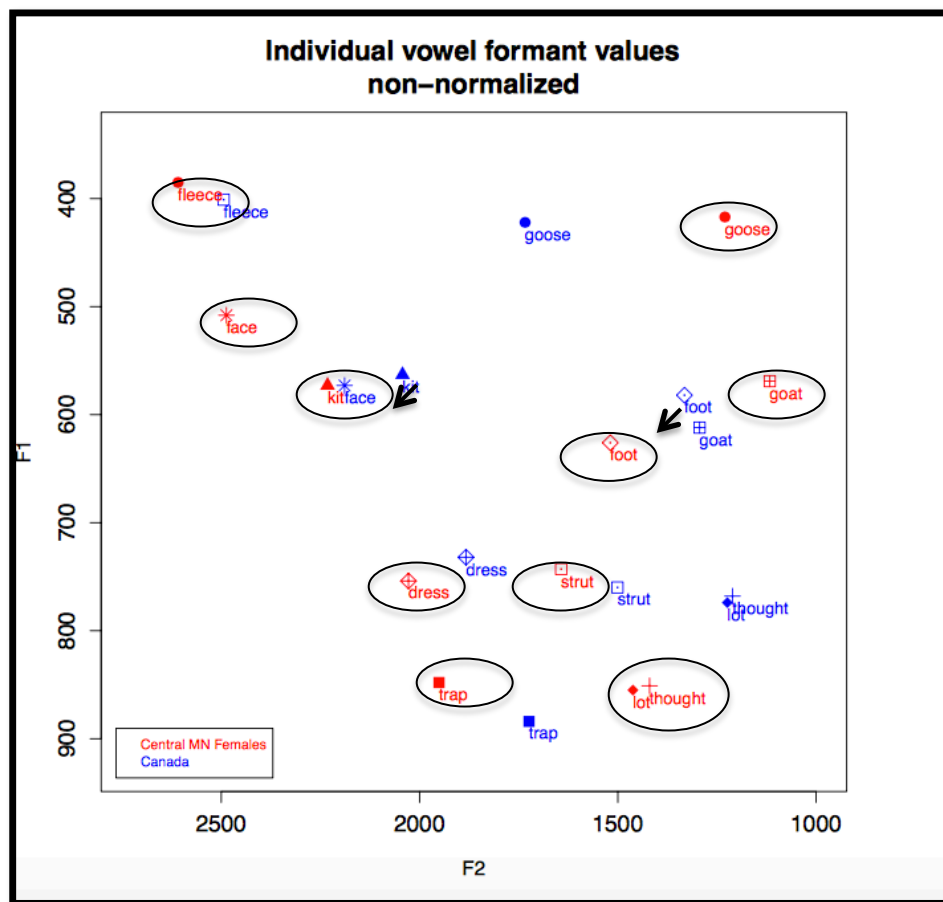


Figure 6: Central Minnesota vs. Standard Canadian English Vowels

Minnesota sits right below the region of Canada known as “the Prairies.” However, CMNE [ʊ] is acoustically closer to the one produced in British Columbia (619 Hz) and Toronto (607 Hz) than the one produced in the Prairies. This is a sociolinguistic puzzle waiting to be explained by historical and/or migratory patterns.

8.0 Summary

The data in Table 7 summarizes the F1 distances between [ɪ] and [ʊ] in CMNE and their counterparts in the five dialects examined in this paper.

Dialects of English	F1 Lowering of [ɪ]	F1 Lowering of [ʊ]
CMNE vs. GAE	$573 - 430 = 143 \text{ Hz}$	$626 - 470 = 156 \text{ Hz}$
CMNE vs. MWE	$573 - 483 = 90 \text{ Hz}$	$626 - 519 = 107 \text{ Hz}$
CMNE vs. NCS	$573 - 450 = 123 \text{ Hz}$	$626 - 578 = 48 \text{ Hz}$
CMNE vs. SCA	$573 - 467 = 106 \text{ Hz}$	$626 - 586 = 140 \text{ Hz}$
CMNE vs. SCEA	$573 - 563 = 10 \text{ Hz}$	$626 - 582 = 44 \text{ Hz}$

Table 7: CMNE vs. Other Dialects of English

We see that [ɪ] and [ʊ] produced in CMNE are closer to their counterparts in SCAE than in other US dialects. This can lead CMNE talkers to be mistaken for Canadians. A posting on an online discussion group about dialect variation in the US bears this out:

I haven't exactly encountered different dialects, but when I visited my family in California this past summer, many of them commented on my "Minnesotan accent." This one girl thought it was weird that I didn't say "ay" after my sentences because that's how she thought people from MN talked. I explained to her that we don't, at least not where I'm from, but that it's actually an incorrect stereotype as far as I've ever seen one.

Even though this Central Minnesotan did not end his sentences with “ay” as Canadians allegedly do, the California girl was right in perceiving some similarities between his CMNE accent and Canadian English. Maybe it is the ways in which [ɪ] and [ʊ] were produced that led her to observe that the CMNE talker speaks like a Canadian.

The data in Table 8 also shows that [ɪ] and [ʊ] are on a lowering trajectory in all dialects when compared with GAE, which many take as the reference dialect of American English. The lowering of [ɪ] is modest in all dialects except in CMNE and SCAE. The lowering of [ʊ], on the other hand, is unmistakable in most dialects.

Dialects of English	F1 Lowering of [ɪ]	F1 Lowering of [ʊ]
GAE vs. CMNE	$430 - 573 = 143 \text{ Hz}$	$470 - 626 = 156 \text{ Hz}$
GAE vs. MWE	$430 - 483 = 53 \text{ Hz}$	$470 - 519 = 49 \text{ Hz}$
GAE vs. NCS	$430 - 450 = 20 \text{ Hz}$	$470 - 578 = 108 \text{ Hz}$
GAE vs. SCA	$430 - 467 = 37 \text{ Hz}$	$470 - 586 = 116 \text{ Hz}$
GAE vs. SCEA	$430 - 563 = 133 \text{ Hz}$	$470 - 582 = 112 \text{ Hz}$

Table 8: The Lowering of High Lax Vowels in Five Dialects

The downward spiral of [ʊ] puts it on a collision course with [ʌ]. As noted in 3.0, this is already causing intelligibility problems in CMNE, and in some Midwest dialects, as well as in some northern dialects.

ABOUT THE AUTHOR

Ettien Koffi is a professor of Linguistics. He teaches the linguistics courses in the TESL/Applied Linguistics MA program in the English Department at Saint Cloud State University, MN. He has written three linguistic books: *Language Society in Biblical Times* (1996), *Paradigm Shift in Language Planning and Policy: Game Theoretic Solutions* (2012), and *Applied English Syntax* (2015). He is the author of many peer-reviewed articles on various topics in linguistics. His primary area of specialization is at the interface between acoustic phonetics and phonology. He has extensive experience in emergent orthographies and in the acoustic phonetic and phonological description of dialect variation. He can be reached via email at: enkoffi@stcloudstate.edu.

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